Voice, Gesture and Remote Controlled Car

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Abstract

The integration of smart technologies has revolutionized the control of remote-controlled vehicles, leading to the development of a comprehensive and user-friendly control system for smart cars. This study presents a prototype robot car that can be operated using voice commands, smartphone gesture recognition, and traditional remote control methods. The system was built using an Arduino microcontroller, Bluetooth module, motor driver, and DC motors, with a smartphone app serving as the control interface. This paper provides a detailed overview of the system's design, working principle, and specific components used. The results demonstrate the successful operation of the car in response to voice, gesture, and remote control inputs, showcasing its potential for enhancing the user experience in operating remote-controlled vehicles.

Keywords: Voice-Controlled Robotic Vehicles, Gesture Recognition, Remote-Controlled Car, Arduino Microcontroller, Wireless Control System

1. Introduction

The evolution of smart technologies has permeated various features of our daily lives, and the field of remote-controlled vehicles is no exception. With the increasing demand for intuitive and interactive control interfaces, the integration of voice recognition, gesture recognition, and traditional remote control mechanisms has emerged as a promising avenue for enhancing the user experience in operating remote-controlled cars. This research endeavors to explore the seamless fusion of voice, gesture, and remote control technologies, aiming to create a comprehensive and user-friendly control system for smart cars.

Our goal is to create a robot car that can be operated by a person's voice command, smart phone gesture recognition, and traditional remote control method. The above-mentioned system is a prototype of our design. The concept is to build a robot that can be controlled by voice, gesture, and remote control inputs. A mobile phone is used to control the robot; numerous other projects have demonstrated the communication between a robot and a smartphone. To remotely automate the robot, a smartphone is an excellent interface. It has many features that can be useful. For the required work, an Android application with a microcontroller is employed in this design.

The use of Bluetooth technology enables us to connect the android application and the robot. The inputs are passed to the Bluetooth module that receives them. The goal of the robot is to receive inputs and respond to the input command.

The primary objective of developing a voice gesture and a remote-controlled vehicle is to analyze and respond to human speech. Tilting of the mobile phone in different directions to provide inputs and the traditional remote controller method. Using wireless control via an Android smartphone, our aim is to construct a robotic vehicle that leverages advanced smartphone technology

in a straightforward and cost-effective manner.

While robots are operated manually, they can now be operated through voice commands and gestures. This technology establishes a profound technological-human communication relationship. The overarching goal is to create a robotic car that can be controlled using voice, gesture, and remote controller

2. Literature Review

This project builds a voice-controlled vehicle that can be controlled by voice commands and responds according to the particular voice command. The system uses an Arduino Uno, Bluetooth module (HC-05), and Android application for voice commands [1]. This paper presents a voice command robotics car that can be controlled wirelessly via voice commands directly from the user. The car's movements are facilitated by Arduino UNO, Bluetooth module, DC motors, batteries, and ultrasonic sensors. The system operates in both normal and noisy environments [2]. This project explores the use of mobile phone inertial sensors for gesture recognition, which can be used to control the movements of a robotic car. The system demonstrates the potential of incorporating advanced technology into voice-controlled robotic cars [3]. This paper presents a voice-controlled car that uses an Arduino and Bluetooth module for seamless control. The car can be controlled through buttons on an Android application or by spoken commands of the user, highlighting the user-friendly nature of Arduino-based robotic cars [4]. This project discusses a voice-based direction control system for a robotic vehicle through user commands. The system recognizes voice commands and translates them into directional movements for the car, emphasizing the importance of user input in robotic vehicles [5]. This paper introduces a Bluetooth-controlled robotic car using Arduino, which can be controlled through an Android application that sends commands to the car via Bluetooth. The system demonstrates the potential of IoT integration in voice-controlled robotic cars [6]. This paper presents an Arduino-based voice-controlled robot vehicle that can be controlled through voice commands or buttons on an Android application. The system showcases the user-friendly nature of Arduino-based robotic cars and the potential of voice control in personal mobility [7]. This paper discusses an Arduino-based voice-controlled robot vehicle that can be controlled through voice commands or buttons on an Android application. The system demonstrates the potential of Arduino in various applications, from manufacturing processes to personal mobility [8].

3. Methodology

Arduino Microcontroller: The central processing unit of the system. It receives commands from the Bluetooth module, which then passes the input to the motor driver, which controls the motors on the basis of the received input command.

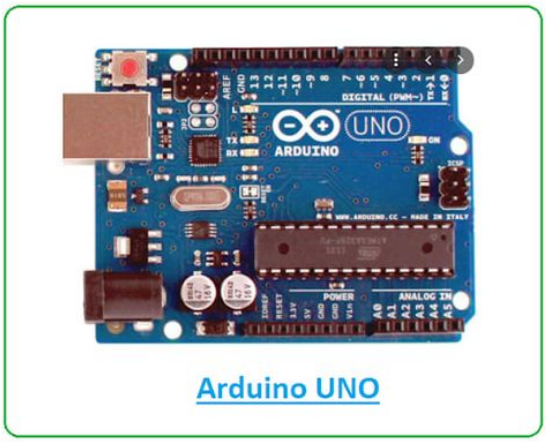

Figure-01 Arduino UNO microcontroller

Bluetooth Module(HC-06): It provides wireless communication between the car and the Android smartphone. The Bluetooth module receives input data from the Android smartphone and forwards the data to the Arduino microcontroller.

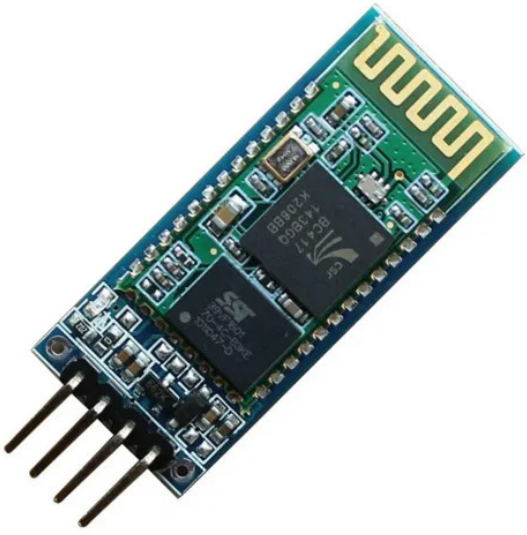

Figure-02 HC-06 bluetooth module

Motor Driver (L293D): The L293D IC motor driver is used to control the speed and direction of the motors that drive the wheels.

One L293D IC is used to drive two DC motors at a time, so we use two L293D ICs in our motor driver shield so that four DC motors can be used at a time. The motor driver receives an input signal from the Arduino and converts it into power levels for the motors.

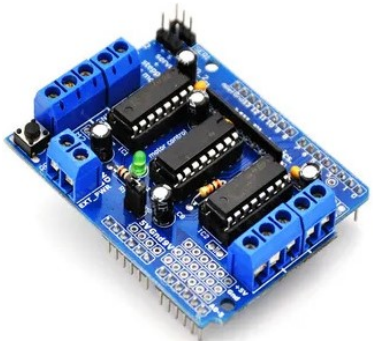

Figure-03 L293D motor driver

DC Motors: These are used to drive the wheels and determine the car's movement. These are connected to the motor driver, which controls the speed and direction of the motors based on the input from Arduino.

Figure-04 DC motors

Power supply: This provides electrical power to all components of the car.

Smart Phone App: A user interface for controlling the car. This sends an input command to the bluetooth module, which forwards them to Arduino. We used the "SriTu Hobby" Application to control the car.

Chassis and Wheels: This is the physical structure of the car. This includes a wooden board and wheels.

Figure-05 Wheels

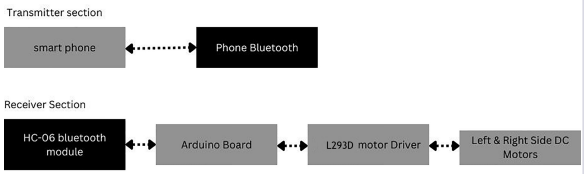

Figure-06 Block Diagram

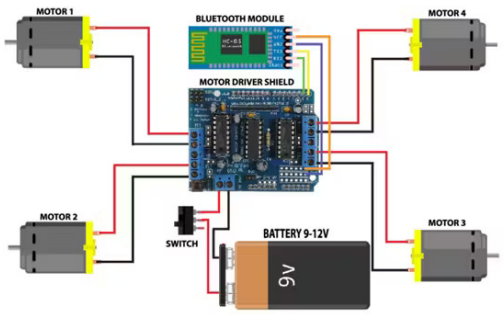

Figure-07 Circuit Diagram

The above block diagram shows the operation of the system. The Arduino is the central processing unit of the system on which all the other components are connected, as shown in the circuit diagram given above. The inputs are given by the user using an Android smartphone application in the form of voice commands, mobile gestures, or a remote controller. The input is then processed and sent to the Bluetooth module, which forwards the input signal to the Arduino microcontroller. Then, the microcontroller gives the commands to the Motor Driver which on the basis of received input drives the motor.

For Voice Commands: Simple voice commands such as forward, backward, left, and right, which are given in the form of human voice, will be processed and converted in the form of text using speech-to-text conversion, and this will be done by a smart phone application using Google speech recognition technology. The text is then sent to the receiver via Bluetooth.

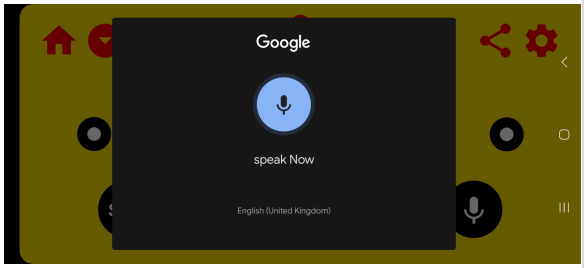

Figure-08 Voice Command Interface

[3] For Mobile Gesture Commands: The Gesture command system consists of three different layers

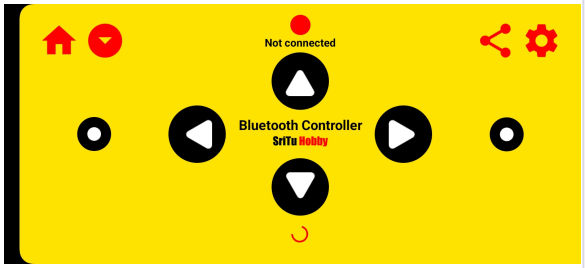

Figure-09 Gesture input interface

I. Sensor layer: This layer includes the gyroscope and accelerometer, which acquire the data provided by the internal sensors. In this study, the acquisition process was performed using a smartphone running Android OS, where data communication was performed by event notifications. In the case of turn gestures, the information collected by the gyroscope allows us to distinguish among the six elementary turns, whereas the accelerometer gives us information about the orientation of the device.

II. Fusion layer: This includes the recognition of the data collected by the sensor layer. To detect when a turn occurs, the fusion layer permanently gathers the data from the gyroscope sensor. The data obtained from the fusion layer is an array of three elements, each of which is related to one axis. If one of the elements of the array increases over a predefined limit, a turn is detected on the corresponding axis.

The accelerometer sensor is enabled, and a fixed number of measurements are taken to estimate the final position. These measurements are averaged, giving a higher weight to later positions in the accelerometer data sequence.

III. Communication layer: This layer transmits the detected gesture to the main system via mobile Bluetooth.

Remote Control Command: Remote control is given by the remote controller interface created in the application. The remote controller has four arrows: forward, backward, left, and right. When we give a command using the forward arrow, the input is sent for the forward command and the car moves in the forward direction and same follows for all the controls.

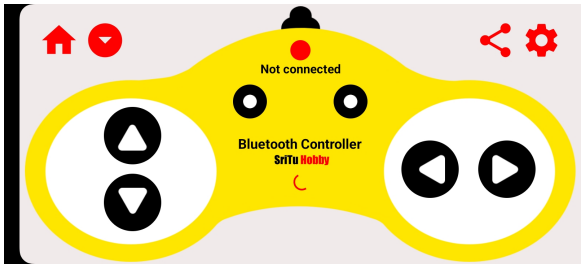

Figure-10 Remote controller

4.Results

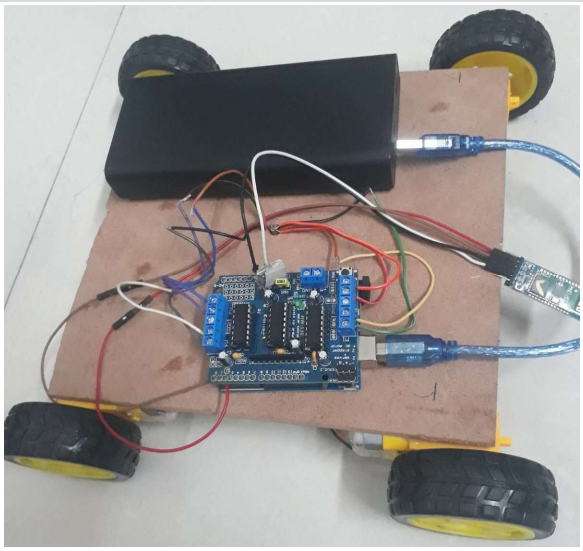

Figure-11 Final assembly

The car is constructed using an Arduino UNO Microcontroller, A Motor Driver, HC-06 Bluetooth Module, DC Motors, Wheels the final assembly system image is given in figure-11. The Arduino IDE is used for programing. The system was tested to assess its performance.

The car is working on the given inputs in the form of voice, gesture, and remote control, and we get the desired output. When the voice commands are given (like:-forward, backward, left and right) we get the desired output. When the user gives the voice command “forward” the car moves in forward direction. When the input is given “backward” it moves in the backward direction, moves left when input is given “left” and right when input is given “right”.

When it is used on Gesture inputs, the car moves forward when mobile phone is tilted forward, moves backward when the phone is tilted backward, left when tilted left and right when tilted right.

Figure-12 Mobile Gesture Inputs

It also works using a remote controller when the upward arrow is pressed it moves forward, when downward arrow is pressed it moves backward, when left arrow if pressed it moves left and right when right arrow is pressed

5.Conclusion

The project on integrating voice, mobile gesture, and remote control for a robotic car has demonstrated the potential for creating a sophisticated and user-friendly human-machine interface. The successful implementation of wireless control using an Android smartphone highlights the adaptability of advanced technologies in simplifying vehicle control. This study not only enhances the user experience of remote-controlled cars but also opens doors for innovative applications in smart transportation and robotics. The seamless fusion of voice and mobile gesture controls reflects a preference for technological solutions, thus establishing a significant technological-human communication relationship. As we move forward, these findings contribute to the ongoing advancements in interactive and intelligent

vehicular systems, paving the way for future innovations in the field.

6.References

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